Predictions of the PPC Law of Gravity

Author: Pawan Upadhyay
Independent Researcher
Email:pawanupadhyay28@hotmail.com

Abstract

The Pawan Upadhyay's-
Pressure–Curvature (PPC) Law of Gravity identifies gravitational pressure—not mass alone—as the physical cause of spacetime curvature. In this framework, energy density generates a pressure field, pressure gradients produce forces, and these forces shape curvature and motion. This research paper systematically presents the theoretical and observational predictions arising from PPC gravity. These predictions span gravitational fields, compact objects, gravitational waves, cosmology, rotational dynamics, and the stress–energy tensor. The PPC predictions provide clear, testable deviations from classical gravity and offer a unified physical mechanism for gravitational and cosmological phenomena.

1. Introduction

The PPC Law of Gravity proposes that energy density creates gravitational pressure and that this pressure is responsible for spacetime curvature. This reinterpretation does not modify Einstein's equations but clarifies the causal mechanism hidden within the stress–energy tensor.

If gravitational pressure is the true physical driver of curvature, then multiple new and testable predictions naturally arise. These predictions distinguish PPC gravity from Newtonian gravity and from purely geometric interpretations of General Relativity.

This paper presents these predictions in a structured, scientific format.

2. Predictions About Gravitational Fields

2.1 Gravity depends on pressure, not only mass

PPC predicts that gravitational fields depend directly on:

energy density, and

internal pressure of matter.

Thus two bodies of equal mass but different internal pressures produce different curvature.

Prediction 1:

High-pressure objects generate stronger gravity than predicted by GR, even with identical mass.

2.2 Pressure-dominated regimes produce enhanced curvature

In extremely dense astrophysical systems (neutron stars, quark stars), pressure can exceed mass density.

Prediction 2:

Near-surface curvature in high-pressure stars should exceed GR predictions.

2.3 Pressure gradients create measurable deviations in gravitational fields

When pressure changes sharply within a star or planet, the curvature deviates from GR solutions.

Prediction 3:

Regions with strong pressure gradients will show measurable gravitational anomalies.

3. Predictions About Gravitational Waves

3.1 Gravitational waves are pressure waves

PPC predicts that gravitational waves are oscillations of the gravitational pressure field, not purely metric tensor waves.

Prediction 4:

Wave amplitude correlates with pressure fluctuations, not only bulk motion of mass.

3.2 Additional wave modes may exist

Pressure-based gravity can support compressional and longitudinal modes in extreme matter states.

Prediction 5:

Non-tensor gravitational wave modes may be detectable near high-pressure environments.

3.3 Wave propagation speed may vary slightly in extreme pressure

In ultradense environments, gravitational pressure may influence wave speed.

Prediction 6:

Gravitational waves could travel differently through ultra-high-pressure matter than through vacuum.

4. Predictions in Cosmology

4.1 Early universe expansion is pressure-driven

The early universe's massive energy density implies enormous gravitational pressure.

Prediction 7:

Inflation-like expansion arises naturally from extreme early pressure—no scalar field is required.

4.2 Late-time cosmic acceleration arises from pressure drop

As the universe expands, pressure and curvature decrease.

Prediction 8:

Cosmic acceleration is caused by weakened gravitational pressure, not "dark energy."

4.3 Structure formation depends on pressure inhomogeneities

Minor dips in gravitational pressure seed cosmic structures.

Prediction 9:

Galaxy formation arises from pressure minima, not mass alone.

5. Predictions About Compact Stars

5.1 Maximum mass limits differ from GR

Pressure contributes directly to curvature.

Prediction 10:

The TOV (Tolman–Oppenheimer–Volkoff) limit is higher than GR predicts.

5.2 New types of ultra-dense stars should exist

PPC predicts stability in pressure-dominated stellar objects:

pressure stars

quark-pressure compact stars

hybrid high-pressure configurations

Prediction 11:

Observations should reveal stars more compact than allowed by GR.

5.3 Pressure determines interior curvature

Curvature inside compact stars varies strongly with pressure.

Prediction 12:

Interior curvature signals should differ from standard GR models.

6. Predictions About Rotational Dynamics

6.1 Centripetal and centrifugal forces are combination forces

PPC predicts that both forces arise from the combination of:

gravitational pressure

pressure gradients

surface forces

inertial resistance to curvature

Prediction 13:

Rotational systems will show slight deviations from classical centrifugal balance.

6.2 High-pressure planets and stars show enhanced equatorial bulging

Because pressure increases curvature and resists rotation.

Prediction 14:

Rapidly rotating compact stars should be more oblate than GR predicts.

7. Predictions About Black Holes

7.1 Black hole formation threshold depends on pressure, not mass

Collapse occurs when pressure-driven curvature reaches critical levels.

Prediction 15:

Black hole mass thresholds differ from GR predictions.

7.2 Horizon structure depends on pressure distribution

Rotation + pressure fields may distort horizon geometry.

Prediction 16:

Horizon shape should contain subtle deviations observable in EHT-like images.

8. Predictions About Local Gravity

8.1 Gravity changes with internal pressure

If internal pressure changes (compression, thermal evolution), gravity changes even without mass change.

Prediction 17:

Planetary gravitational field can vary slightly with internal pressure shifts.

8.2 Pressure anomalies create curvature anomalies

Localized pressure pockets can affect gravity.

Prediction 18:

Small gravitational anomalies should exist in geological or stellar pressure variations.

9. Predictions from the Stress–Energy Tensor

9.1 Trace relation

PPC identifies:

$T = -2E_d$

in environments where pressure equals energy density.

Prediction 19:

Ultra-high-energy systems should show curvature patterns matching PPC trace behavior.

10. Summary of PPC Predictions

PPC predicts a universe where:

Pressure is the fundamental driver of curvature

Gravitational waves are pressure waves

Cosmic acceleration results from decreasing pressure

Compact objects behave beyond GR limits

Centripetal and centrifugal forces arise from combination pressure–inertia effects

Local gravity responds to internal pressure changes

These predictions make the PPC Law testable, falsifiable, and experimentally relevant.

11. References

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